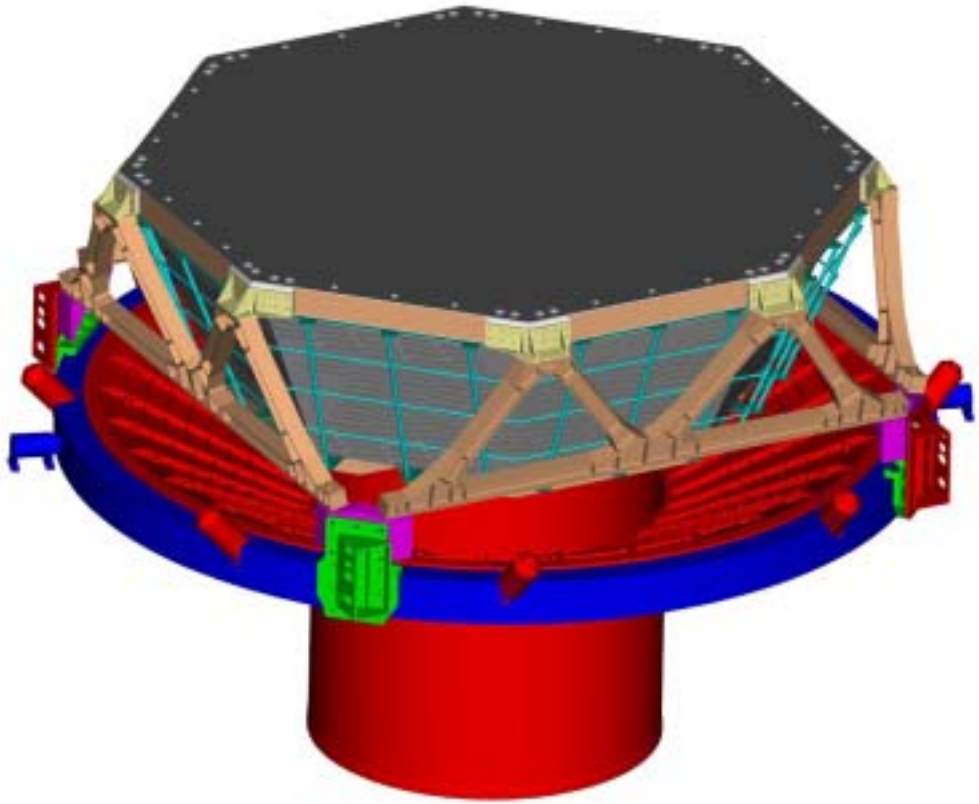
Agenda TRD Report

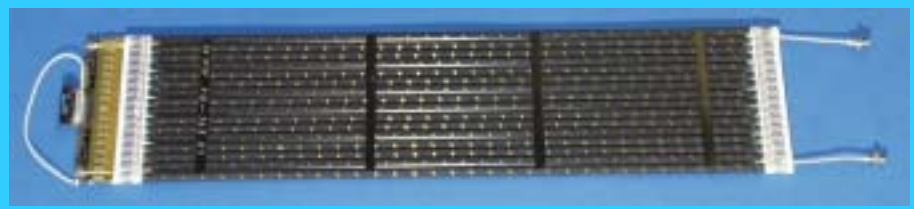
1.)	TRD production status	St. Schael	30 min
2.)	M-Structure and Zenith Radiator	K. Lübelsmeyer	10 min
3.)	TRD Gas System	U. Becker	20 min



TRD Production Status

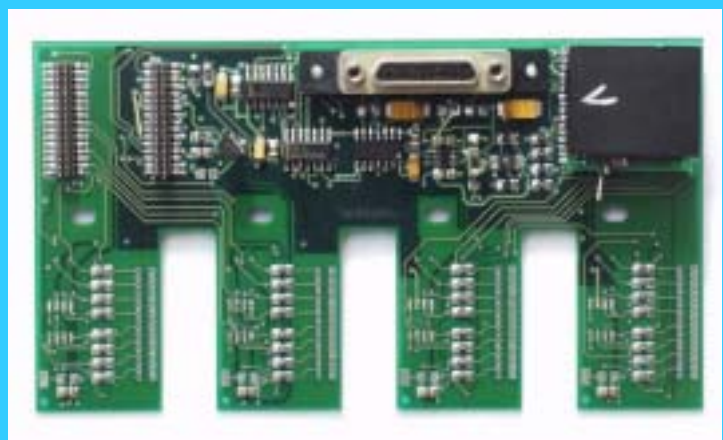
St. Fopp, K. Lübelsmeyer, W. Karpinski, Th. Kirn, St. Schael
G. Schwering, Th. Siedenburg, R. Siedling, A. Schultz von Dratzig
RWTH Aachen

- **TRD Module Production**

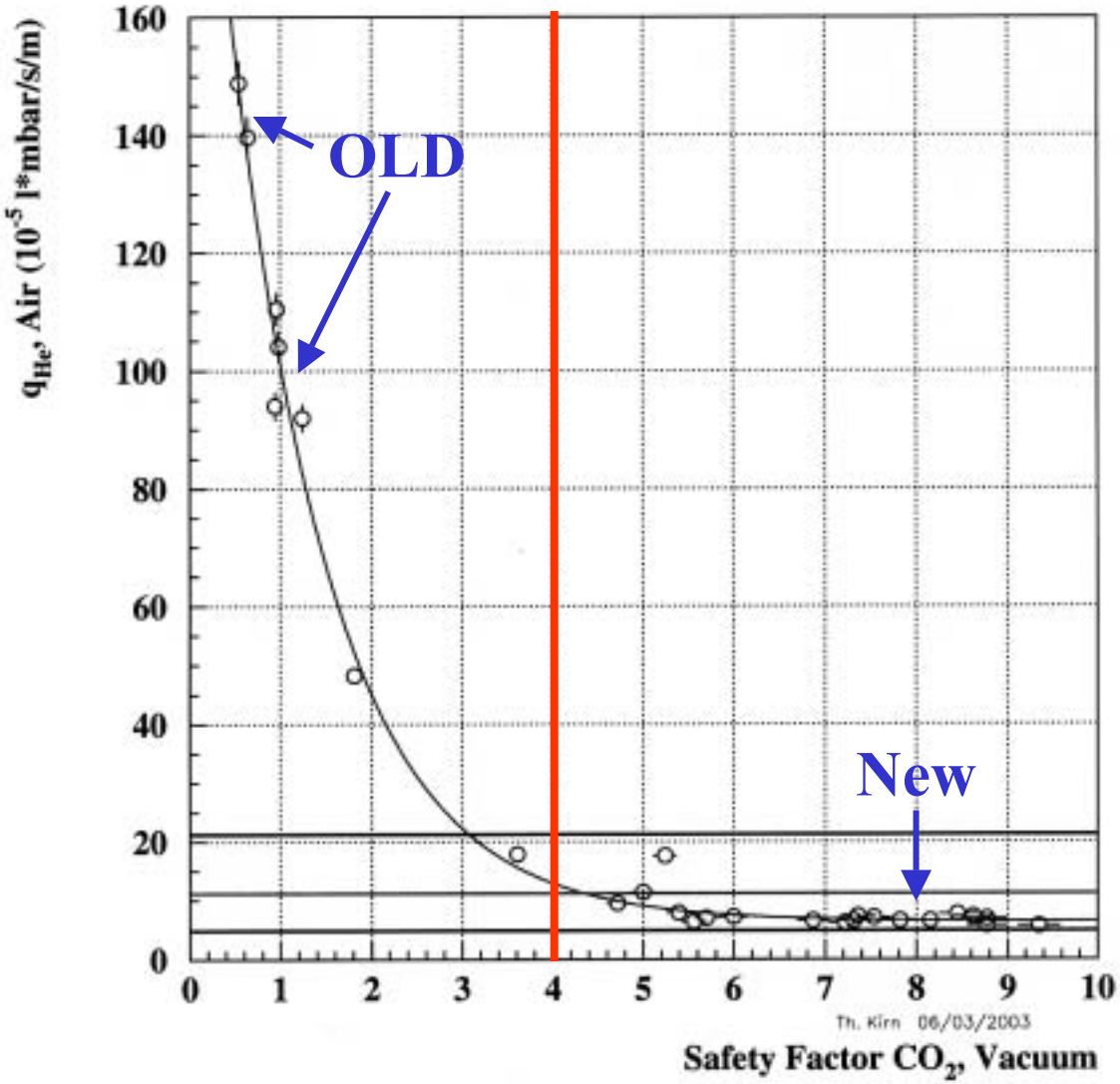


- **TRD Support Structure**

- **TRD FE-Electronic**

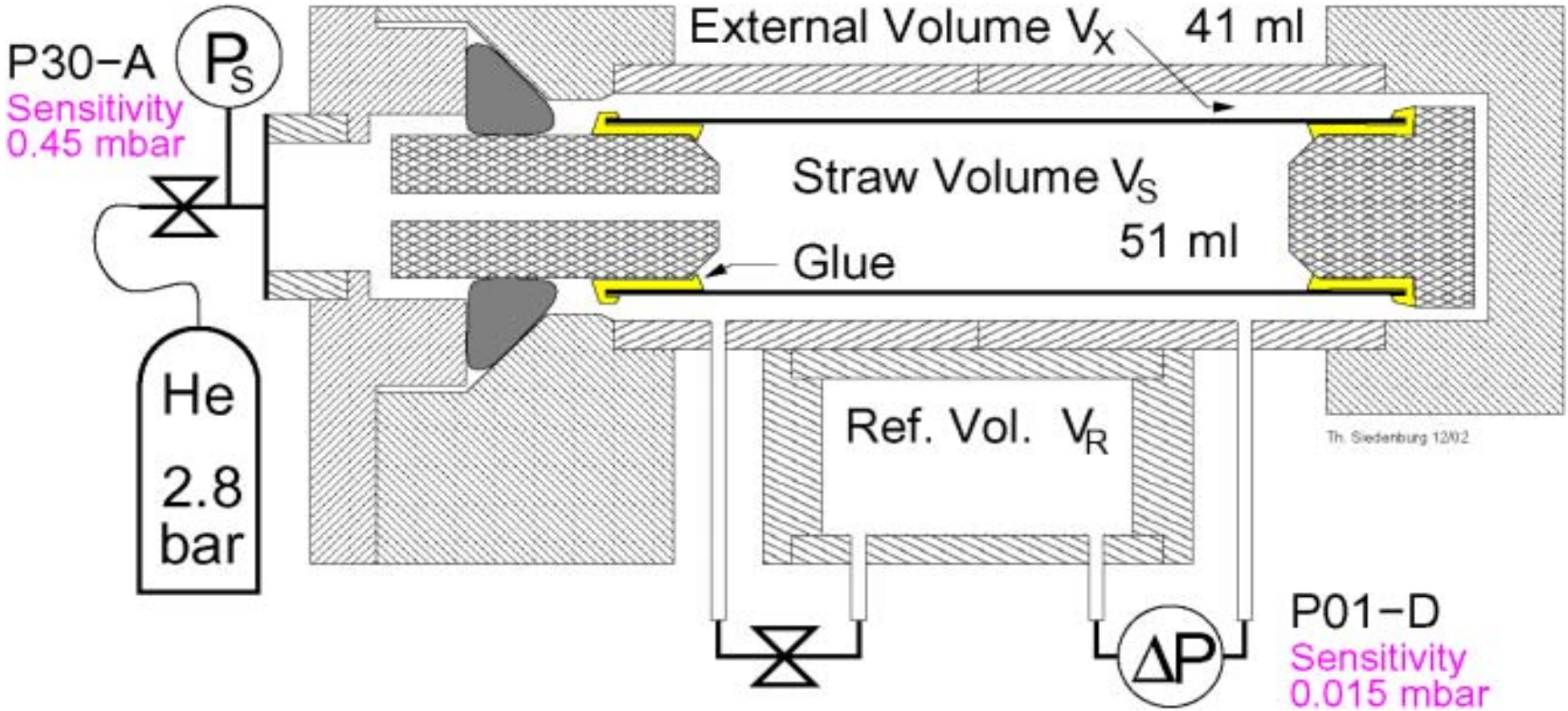


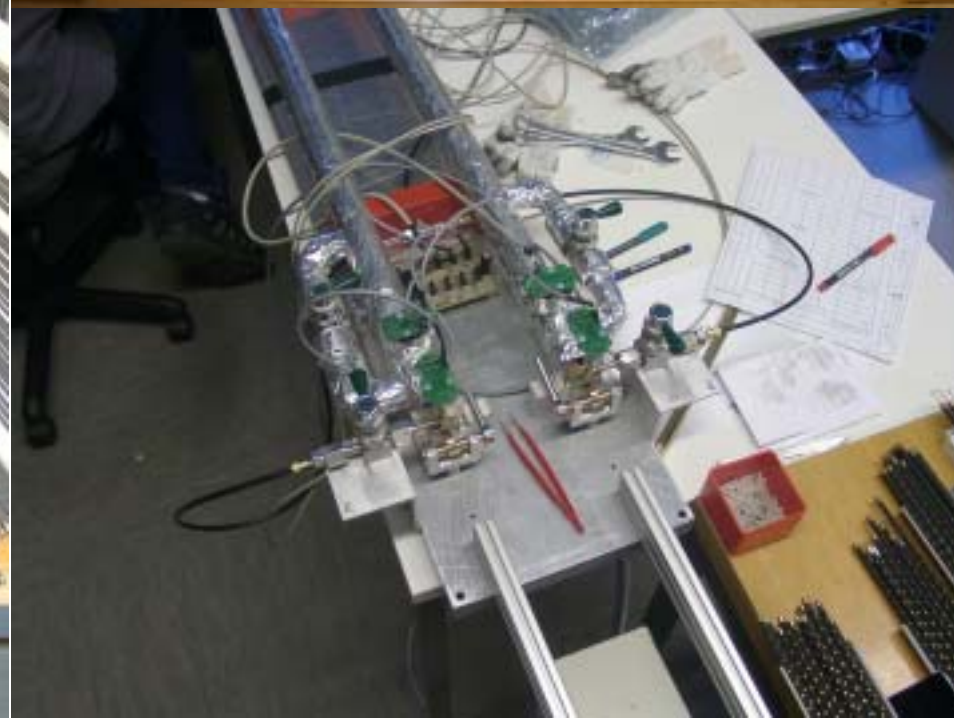
TRD Module Production



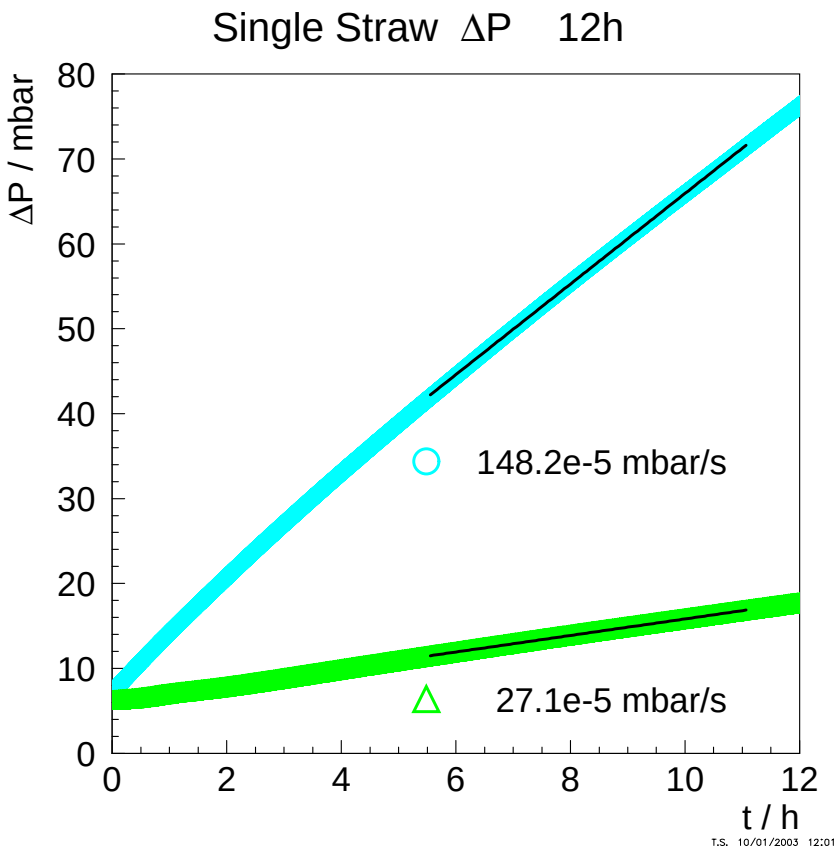
- We aim for a safety factor of >4 ⇔ >12 years on ISS
- He measurements are much faster than CO_2
- He vs CO_2 show a very good correlation
- Safety factor of 4 ⇔ He leake rate $11*10^{-5}$ l*mbar/s/m

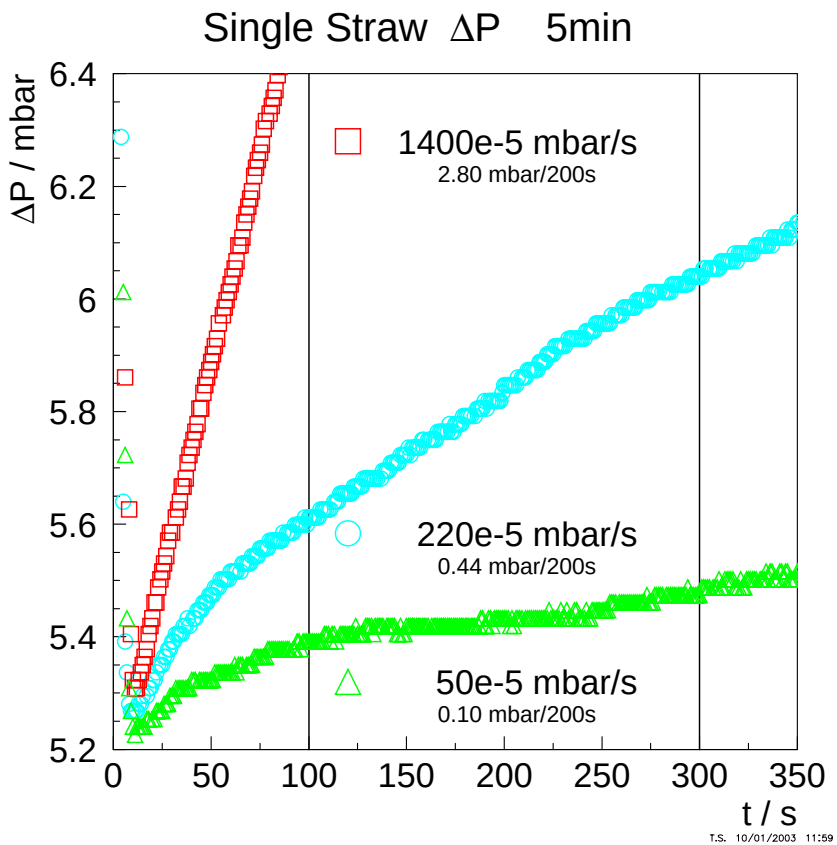
Single Straw Test Setup

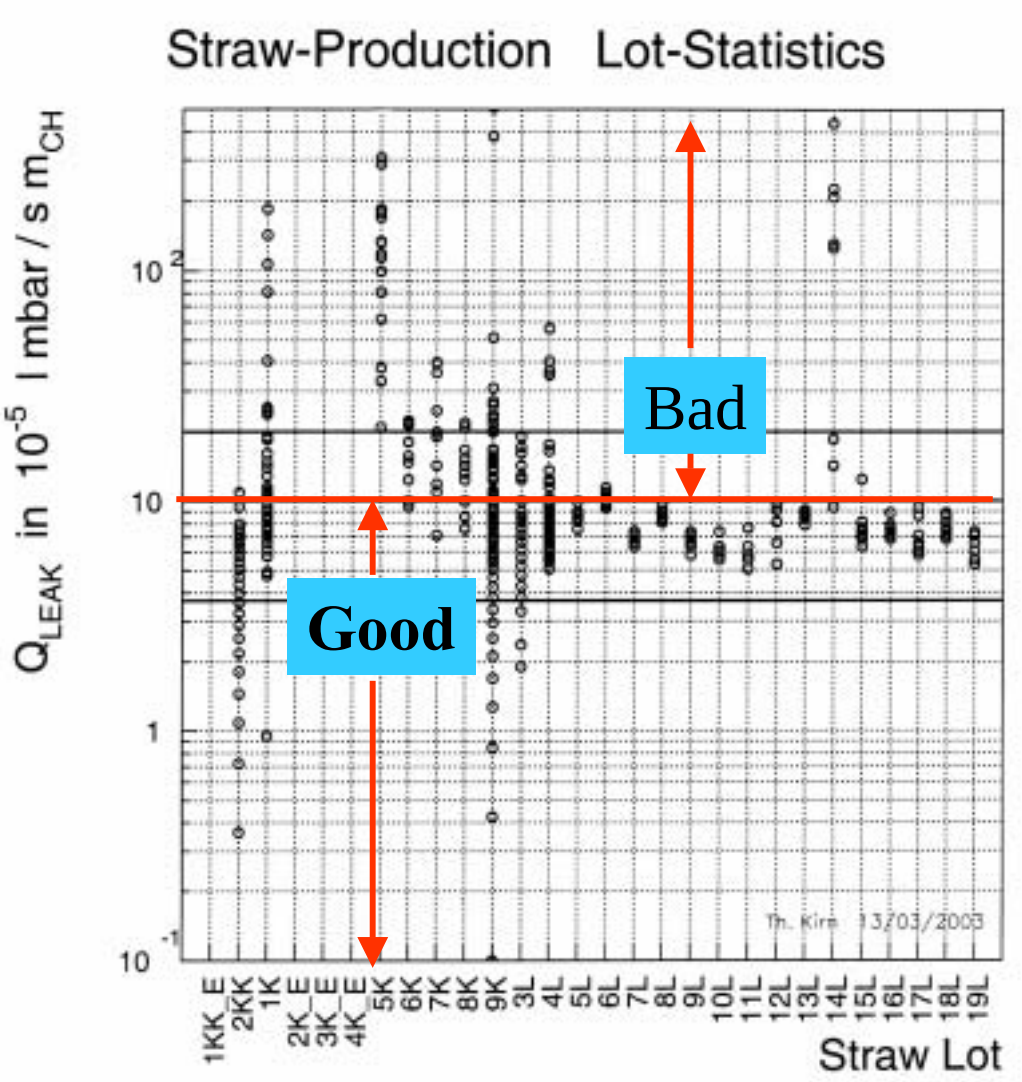


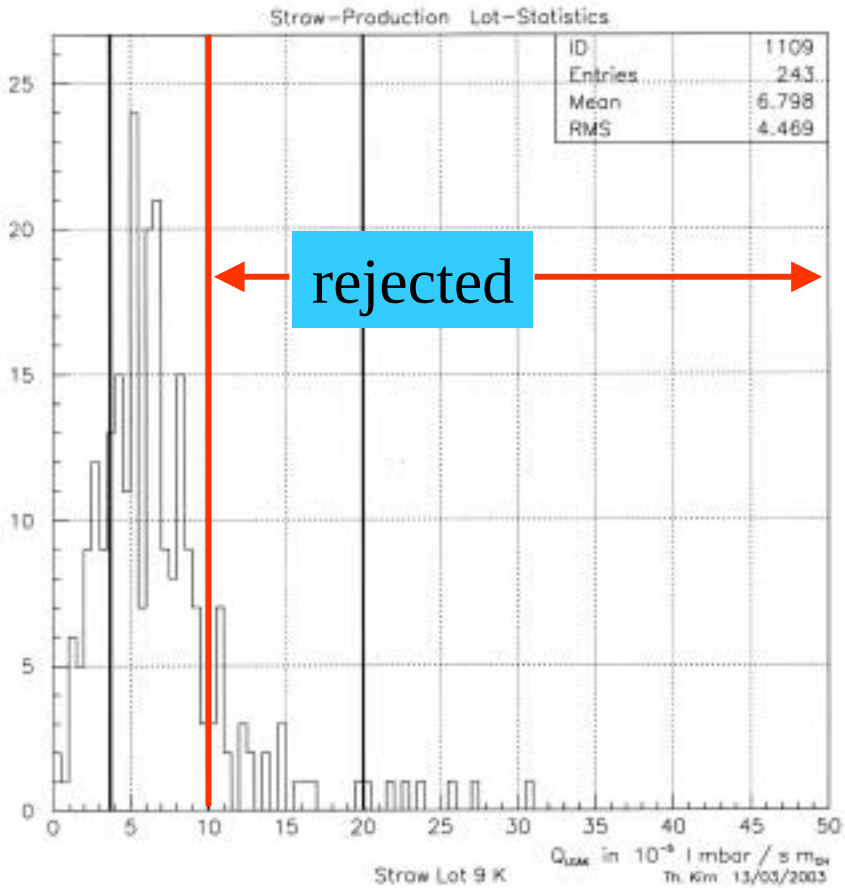


Single Straw Tests

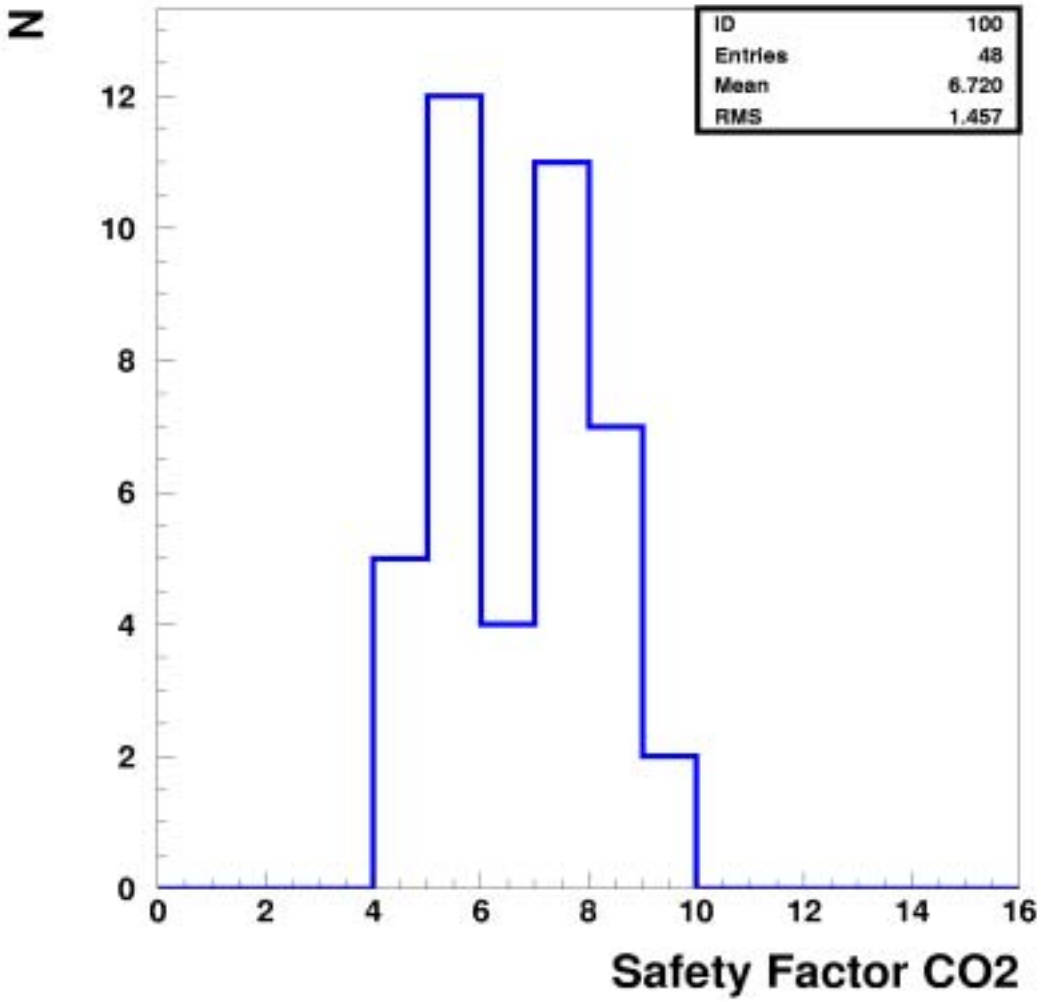




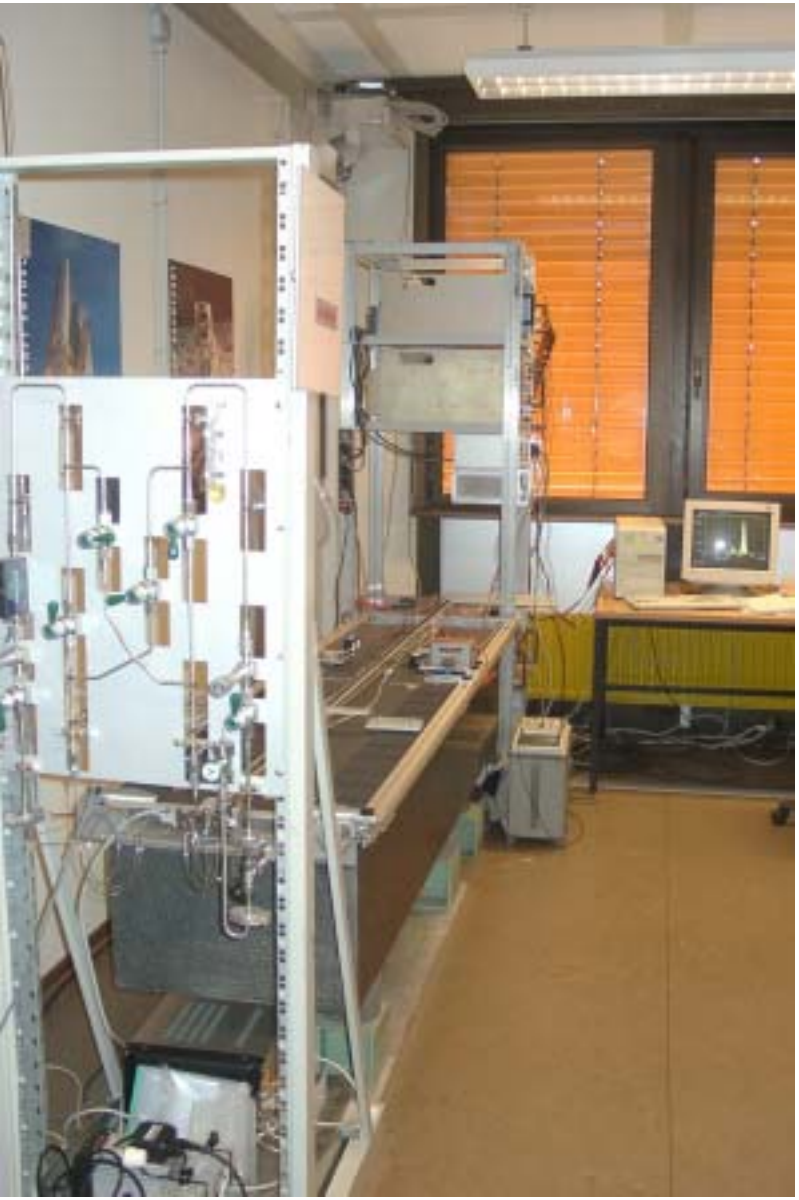




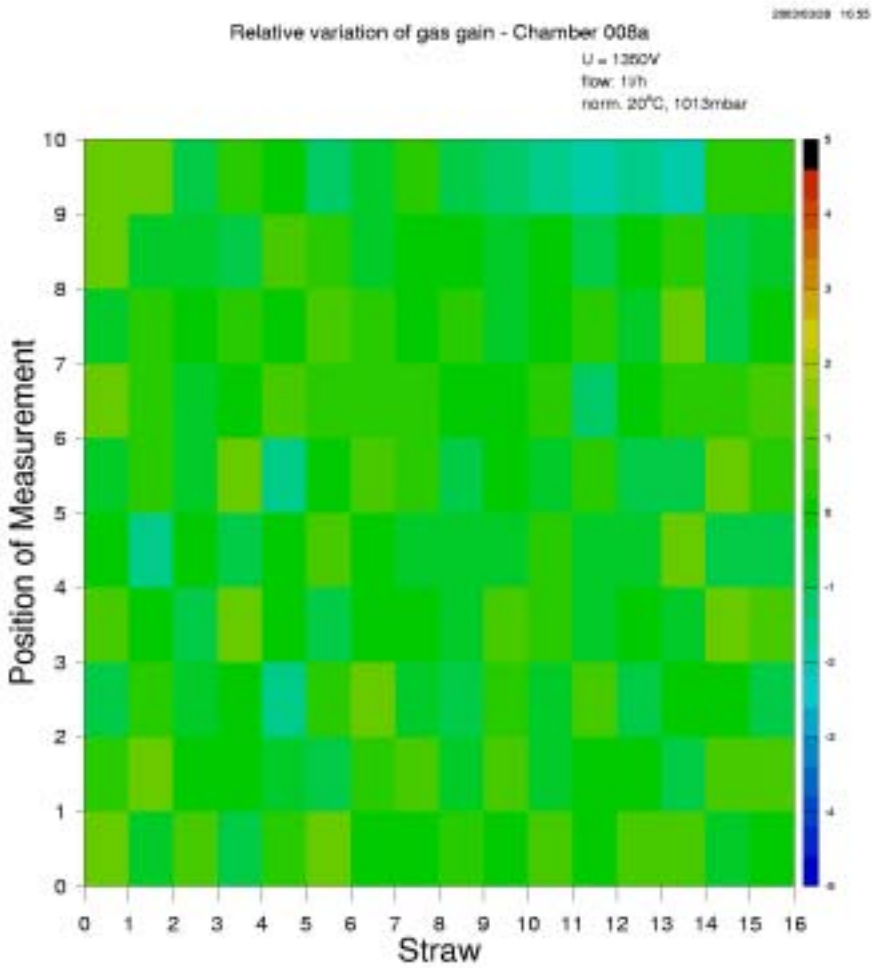
- **We will produce 50% additional straws, delivery time 2 month**

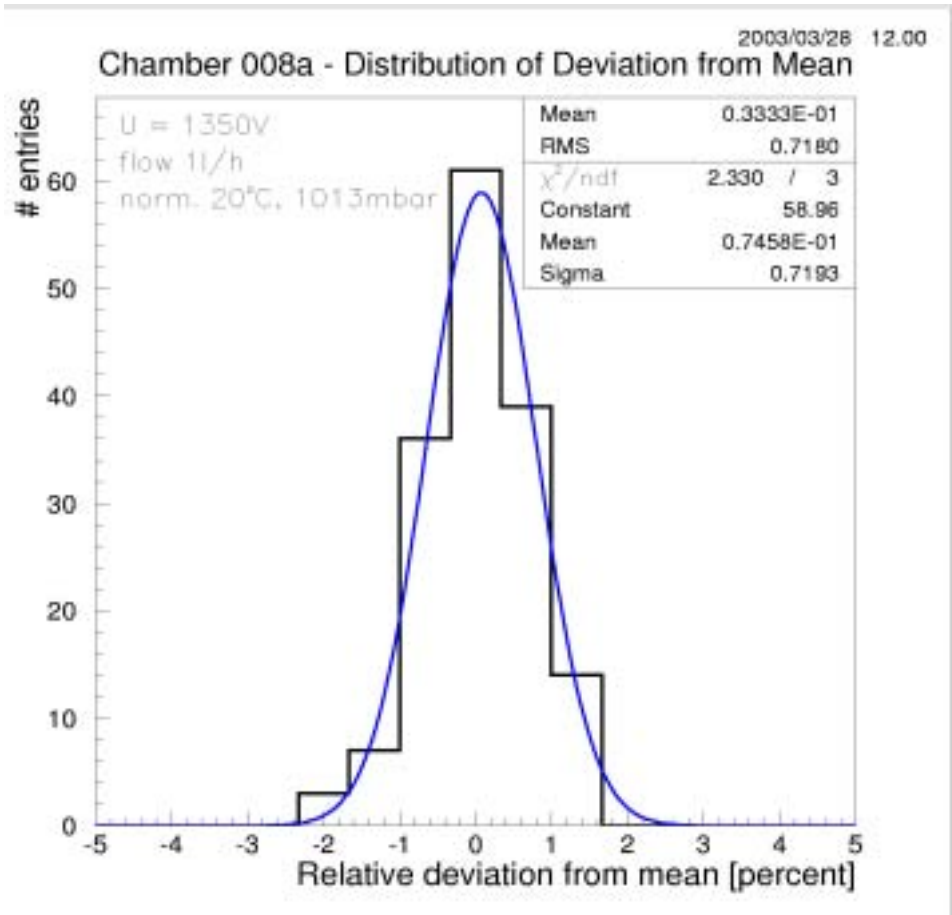

N
ID 100
Entries 48
Mean 6.720
RMS 1.457
0
2
4
6
8
10
12
14
16
Safety Factor CO2

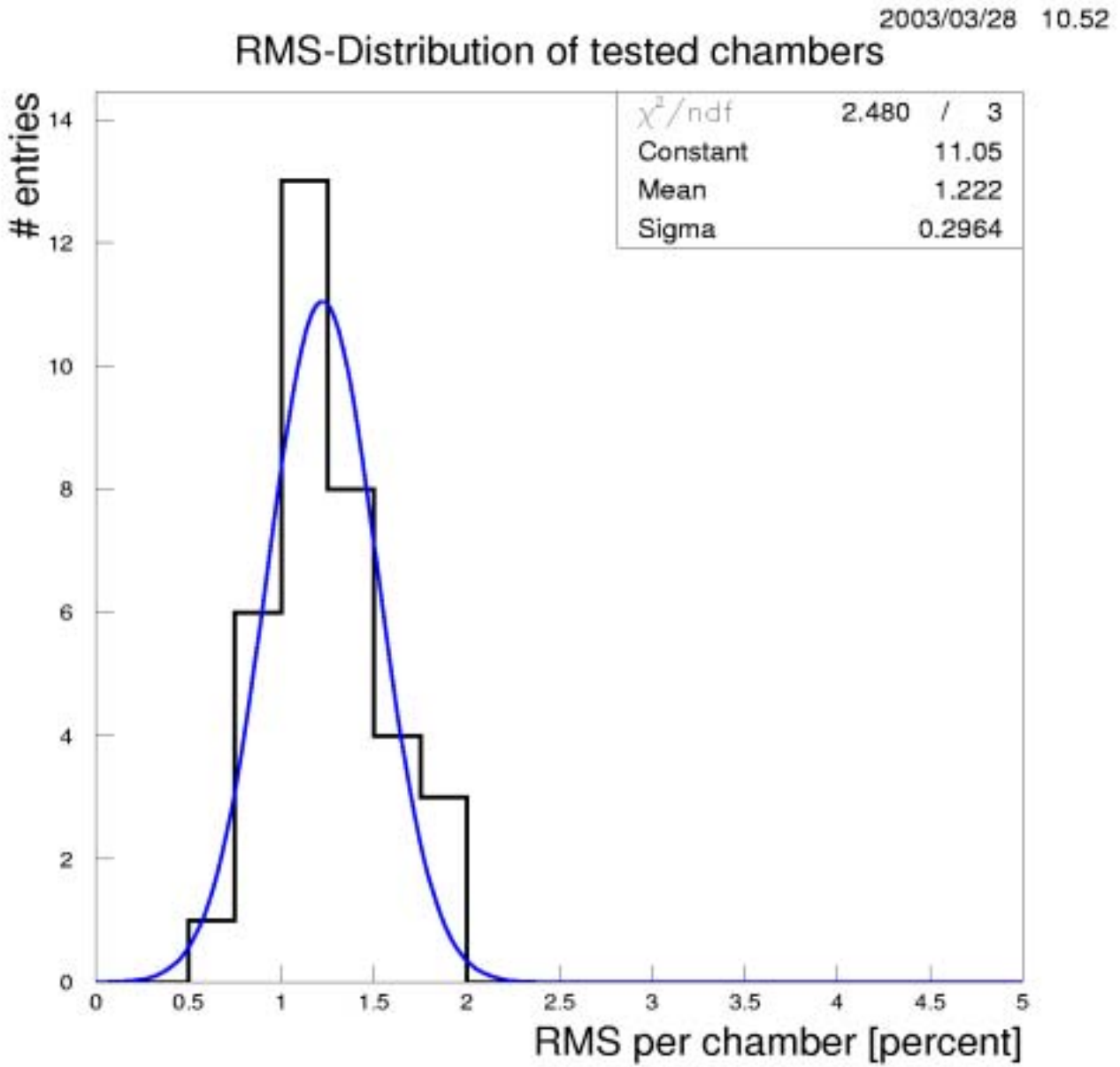
Gas Gain Measurement



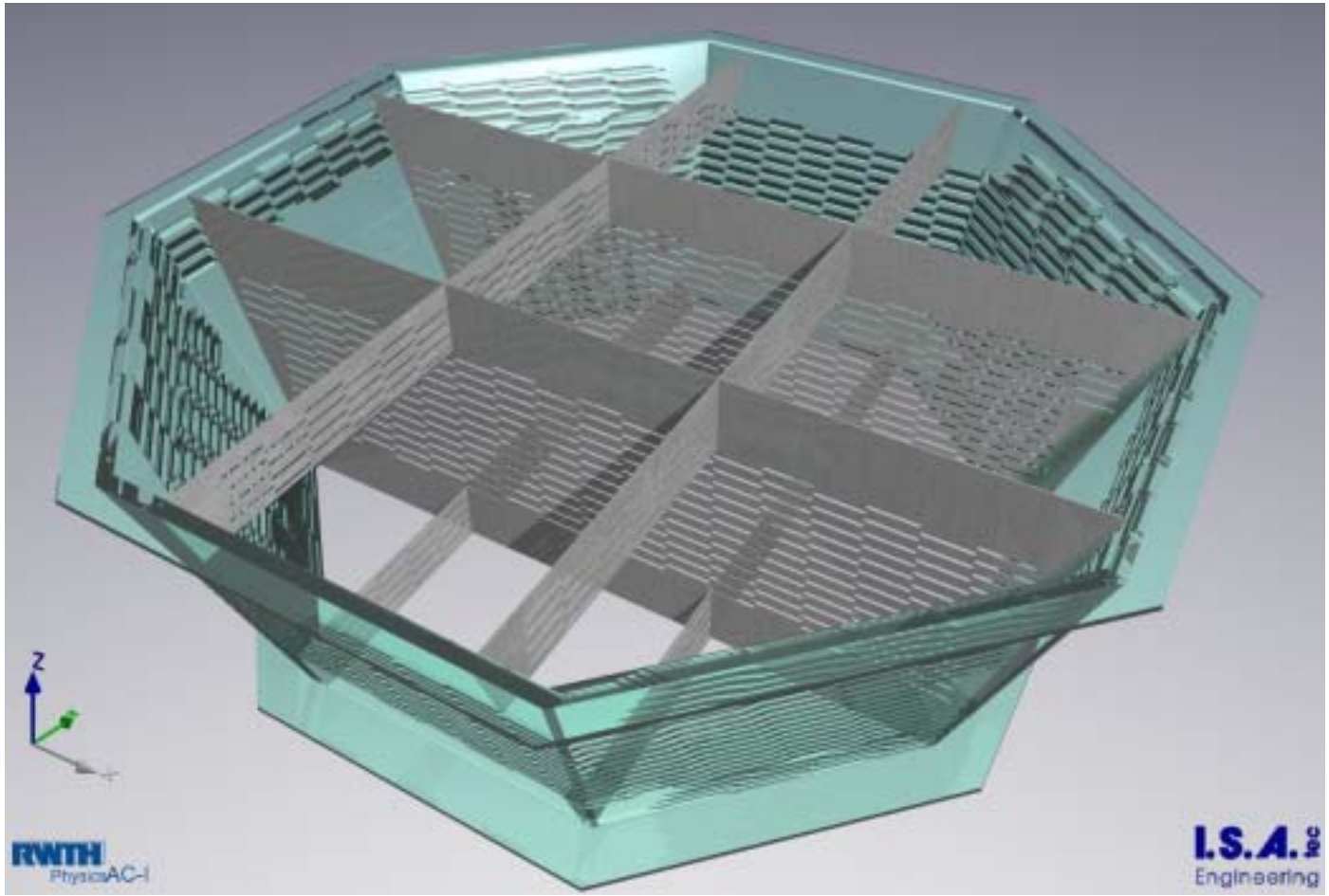
Variation of the gas gain





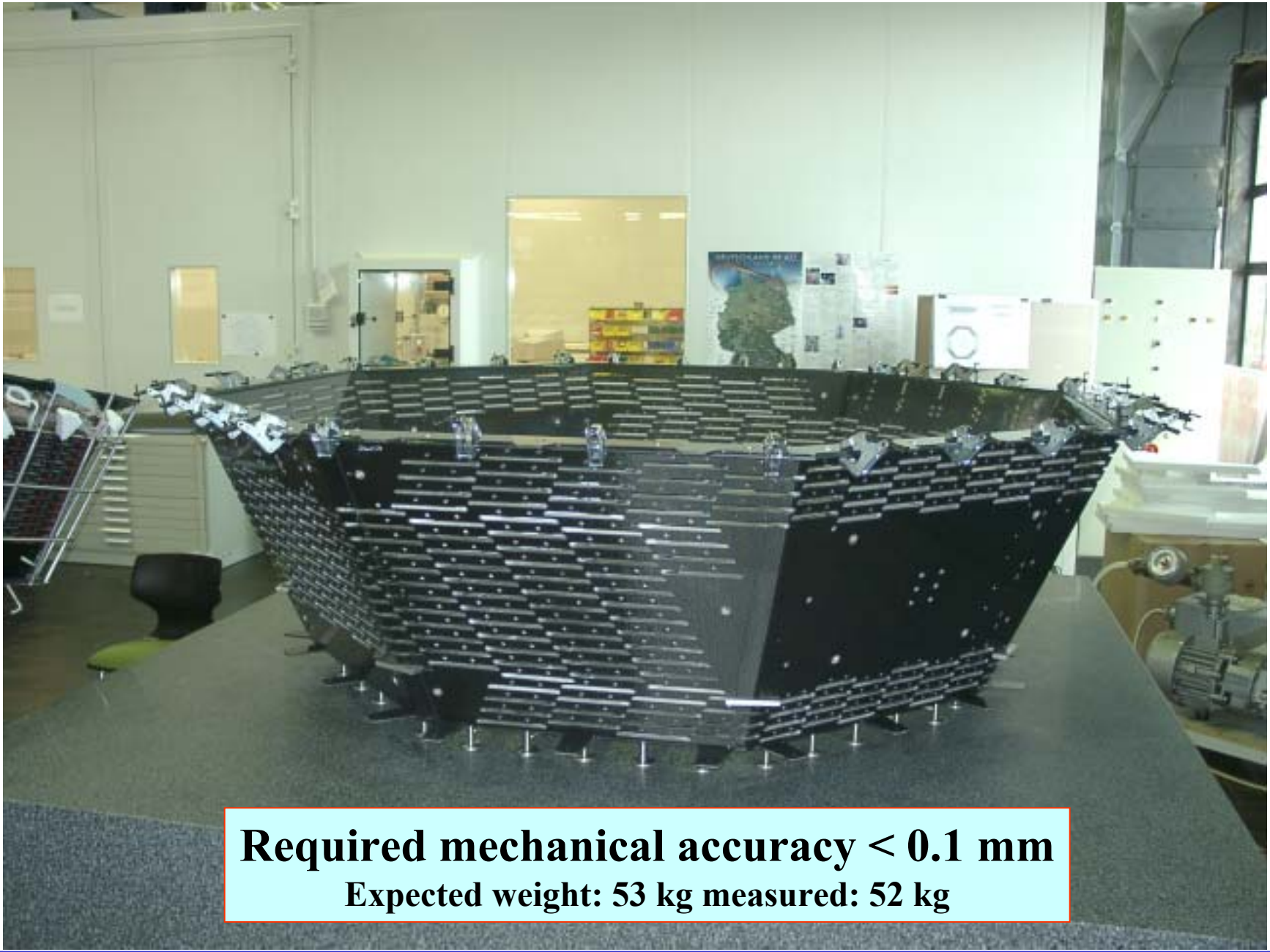

2003/03/28 10.52
RMS-Distribution of tested chambers
χ²/ndf 2.480 / 3
Constant 11.05
Mean 1.222
Sigma 0.2964
entries
0
2
4
6
8
10
12
14
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
RMS per chamber [percent]

TRD Support Structure



Production Status:

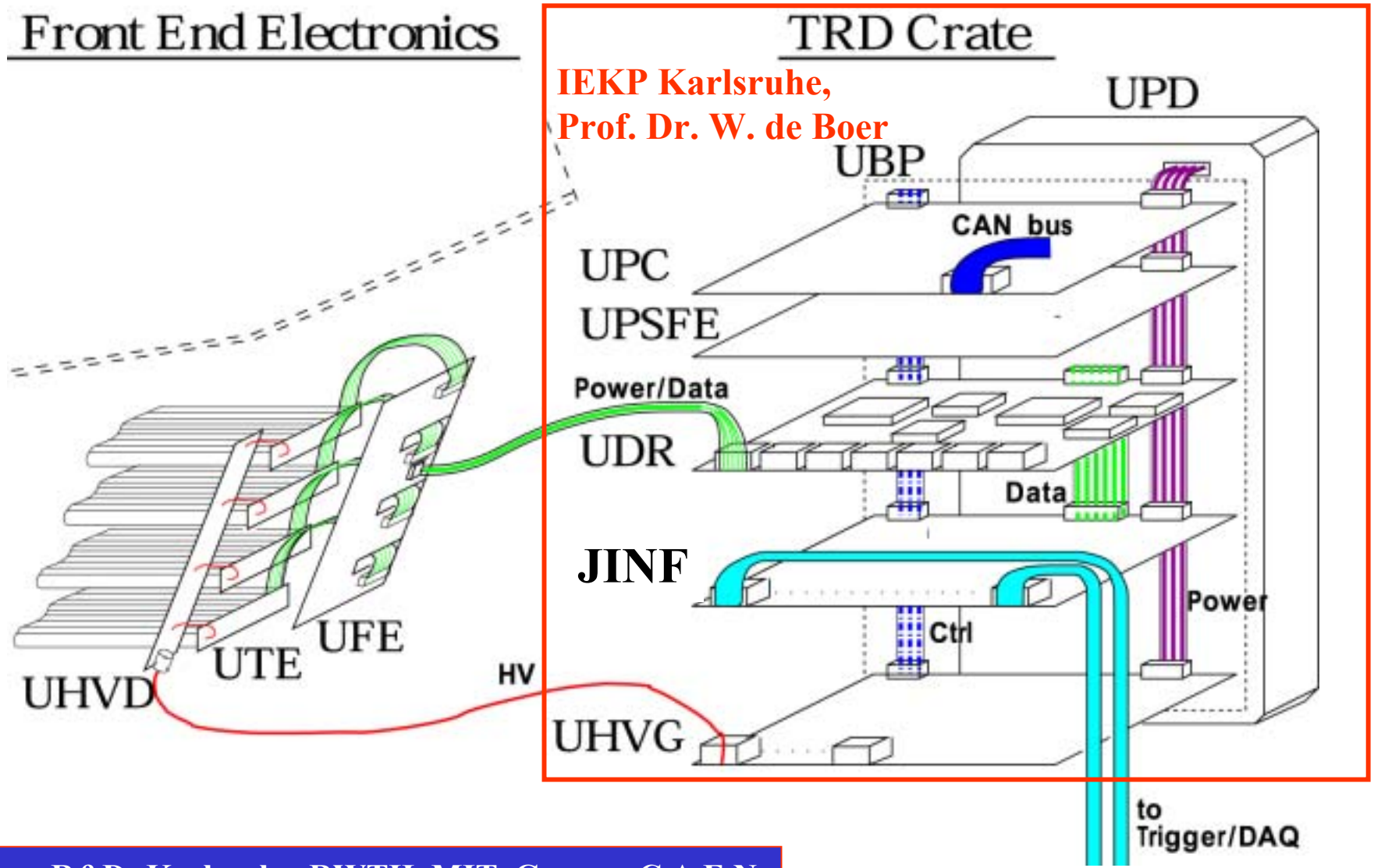
- **Octagon walls: delivered**
- **Bulk head delivered**
- **Re-enforcement ring delivered**
- **Lower plate delivered**
- **Upper plate pending**



Required mechanical accuracy < 0.1 mm

Expected weight: 53 kg measured: 52 kg

Front End Electronics



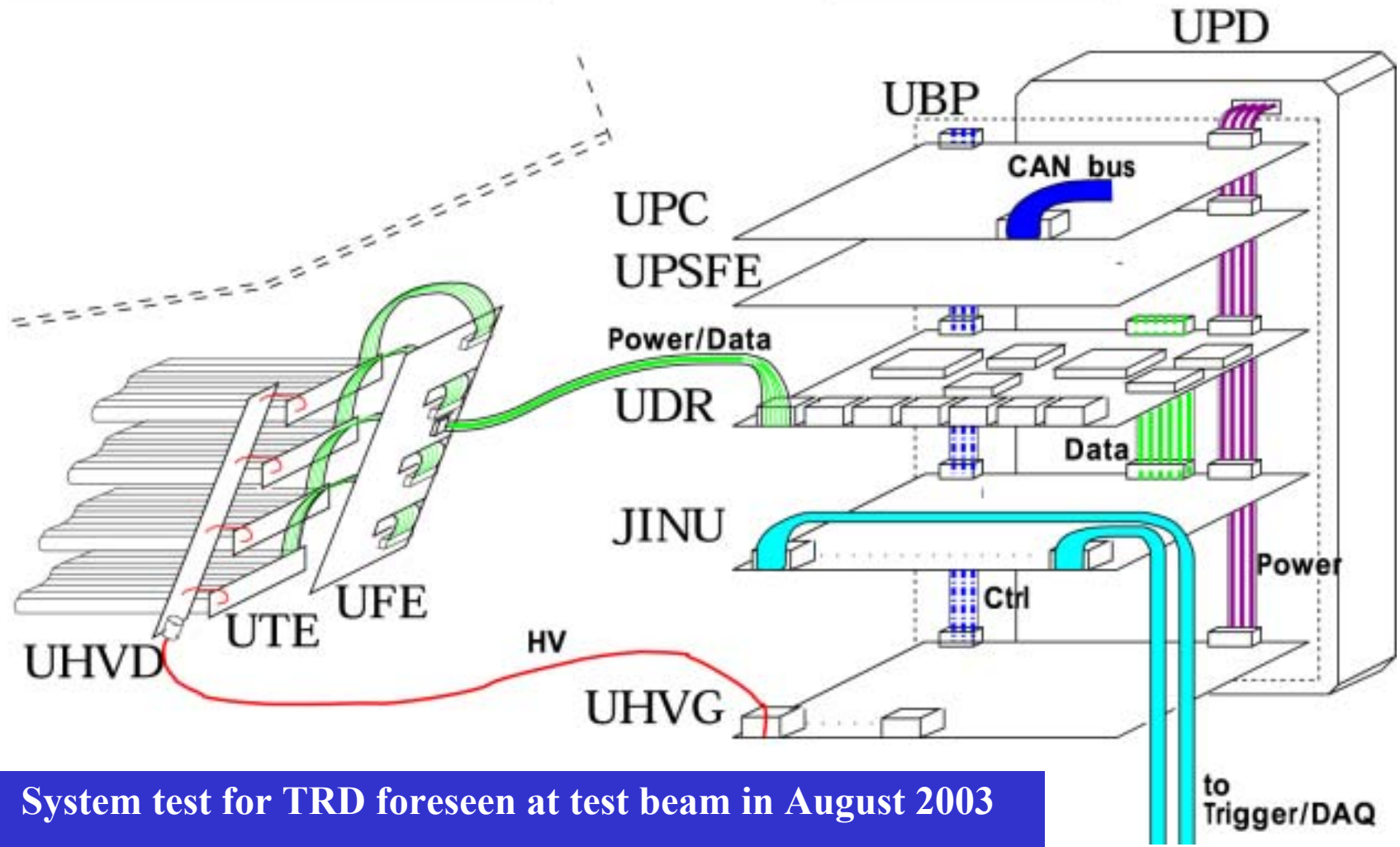
- R&D: Karlsruhe, RWTH, MIT, Geneva, C.A.E.N.
- Production: CSIST (Taiwan)

- **Status of UDR2 (Data reduction board)**
- => After some modifications UDR2 worked properly. The OK for EM/QM1 transition was given in December/January. Order has been placed via MIT.
- 4 boards are expected to be delivered July.

- **Status of UPSFE (Power supply for front-end)**
- Transition from EM to QM1: Ok was given 2 weeks ago.
- Order has been placed last week via CERN.
- Expected arrival date is mid of June. (in time)

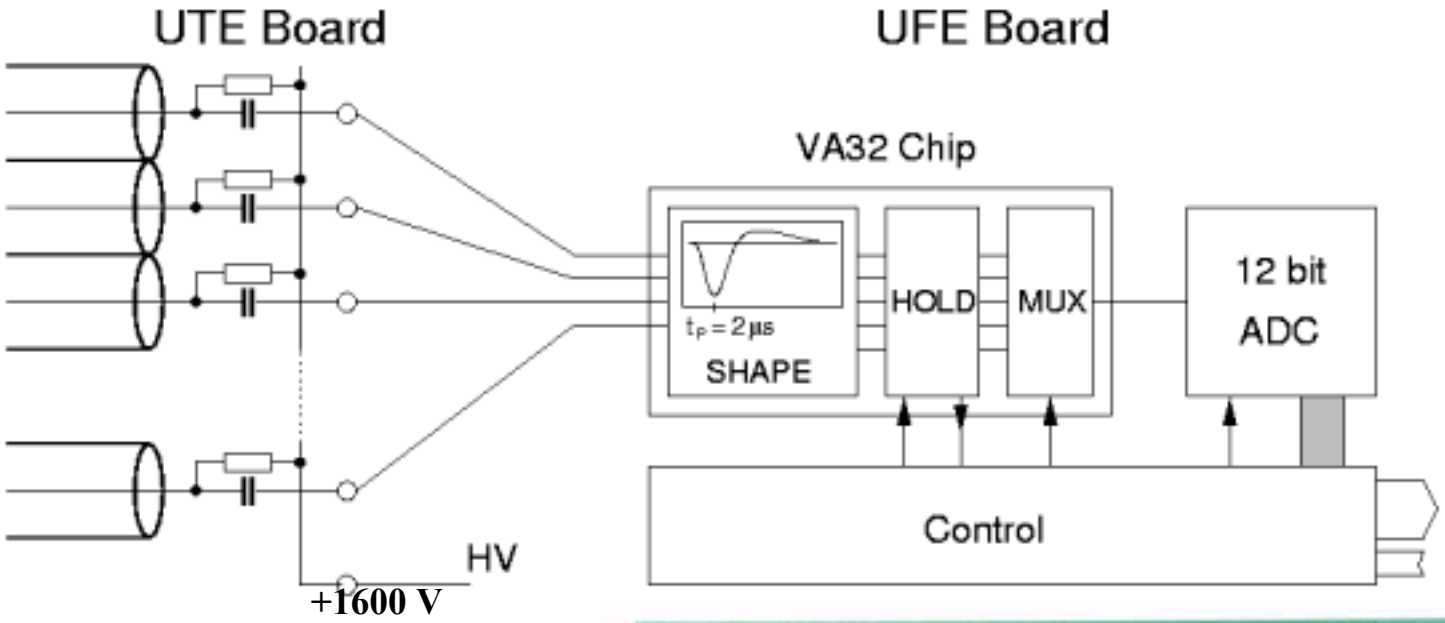
- **Status of UBP (Back Plane)**
- order has been placed 06. January via CERN

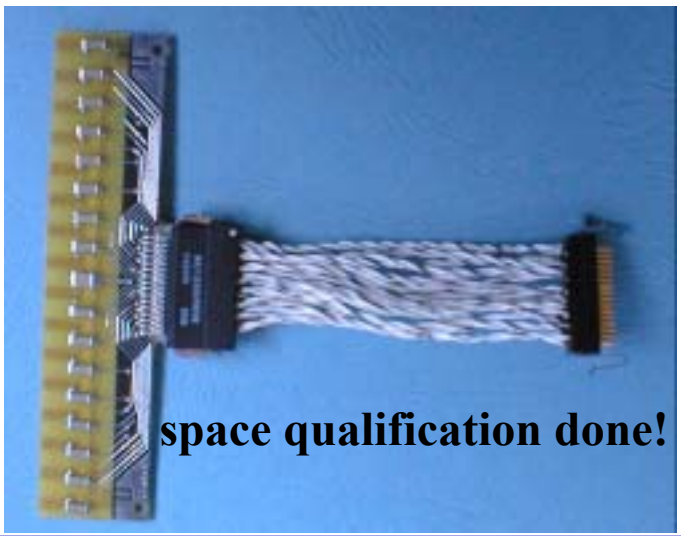
- QM1 backplane is scheduled to arrive end of July
- as UBP will be too late to test UDR2 and UPSFE QM1 modules, intermediate mini-backplane for QM1 will be produced by IEKP

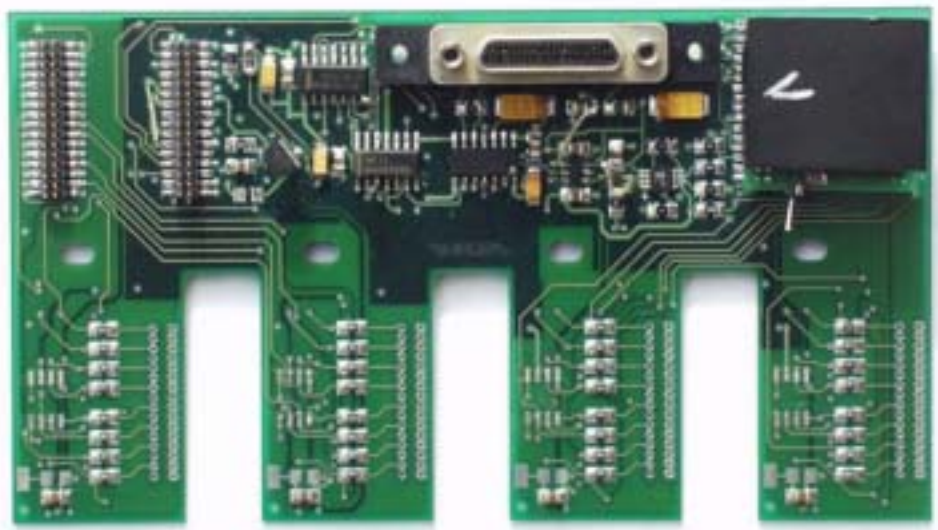


- **System test for TRD foreseen at test beam in August 2003**
- **We would like to have one DAQ power group operational: 2 UDR2s, 2 UPSFEs, 2 UHVG, 1 JINF**

TRD FE-electronics: 328 x 16 = 5248 channels

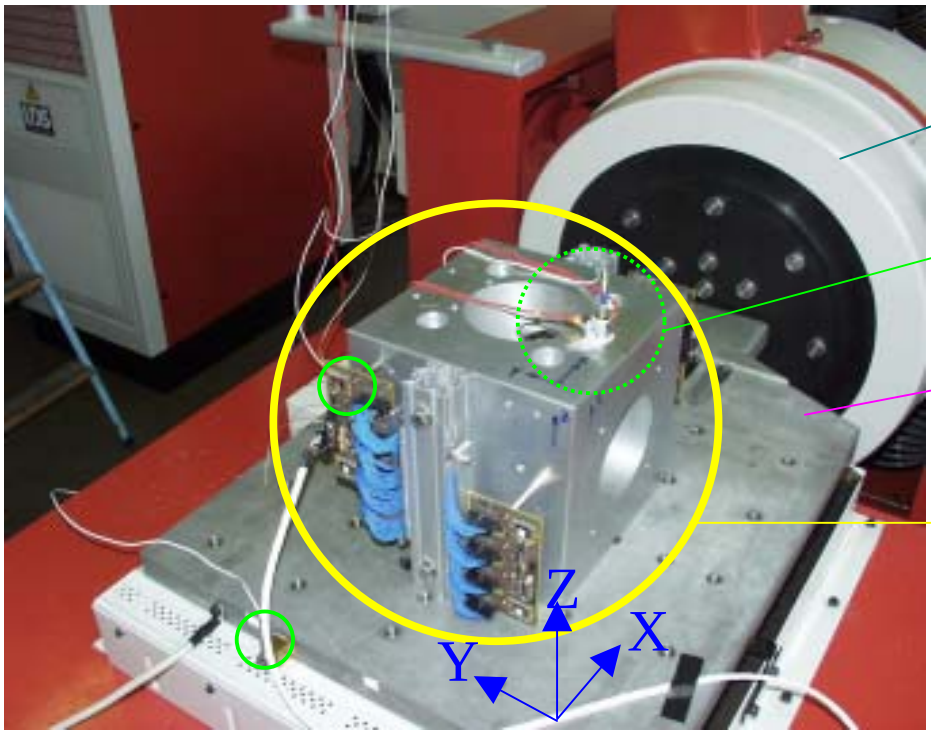






Space Qualification Tests

Mechanical Vibration Setup @Aachen



Vibration Exciter

Accelerometers

Displacer

TRD UFEs
&
Symmetric Al. body

Test Series
Sine -Random -Sine
in 3-D orientations

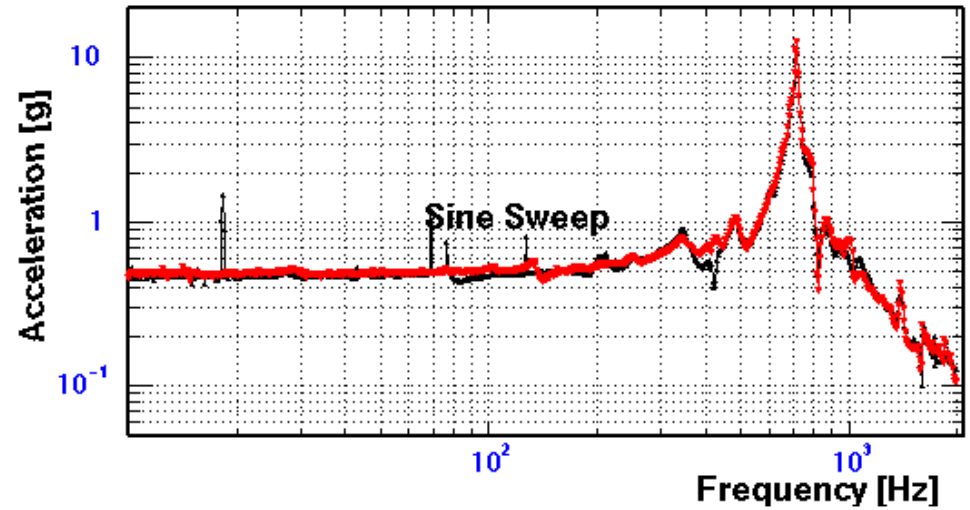
Sine Vibration
(10 ~ 2000 Hz, with const acceleration 0.5 g)

Random Vibration
(Peak vibration level of 0.04 g^2/Hz from 80 ~500 Hz, 90s)

$\mathbf{g_{RMS} = 6.8\ g}$

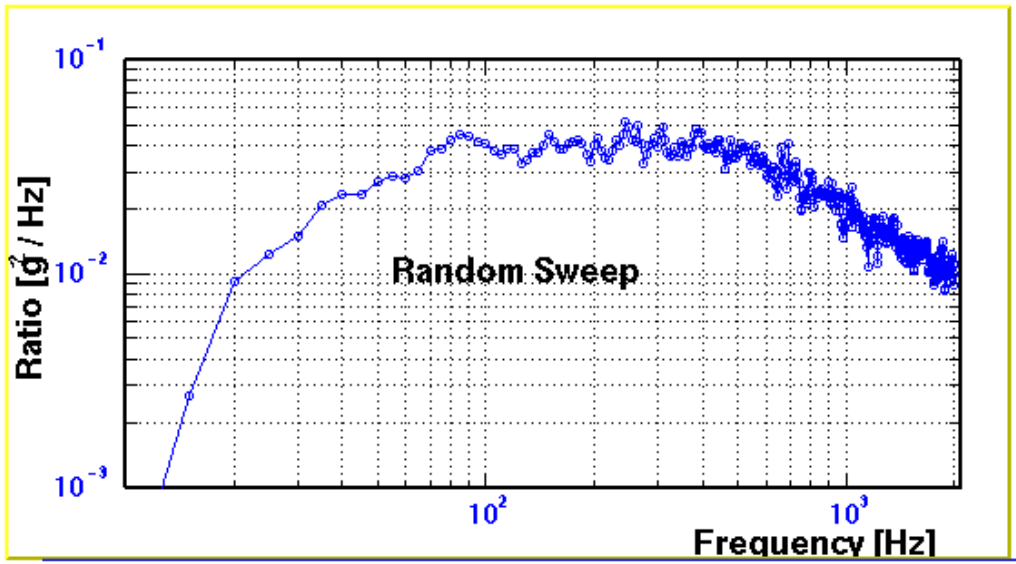
Space Qualification Tests

Mechanical Vibration Mode



Sine Acceleration Mode

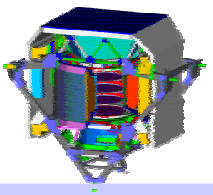
Distinct resonance occurs at a frequency close to a natural frequency of ~ 700Hz



Random Acceleration Mode

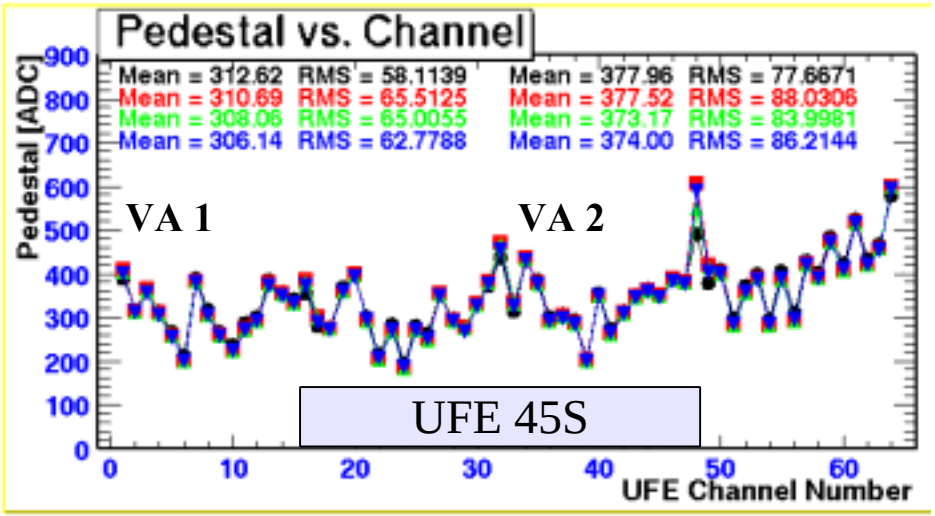
$g_{RMS} = 6.8$ g

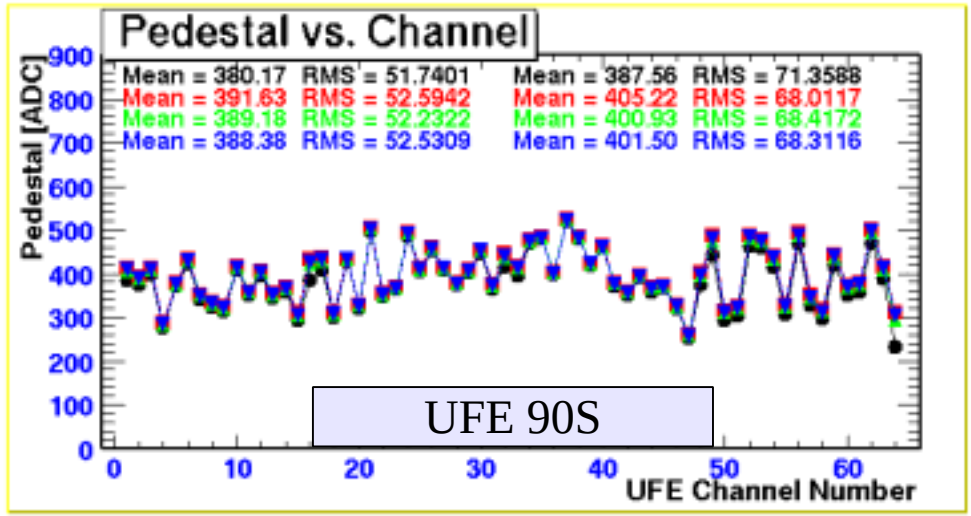
Peak vibration level of 0.04 g^2/Hz from 80 ~ 500 Hz with test durations of 90 s

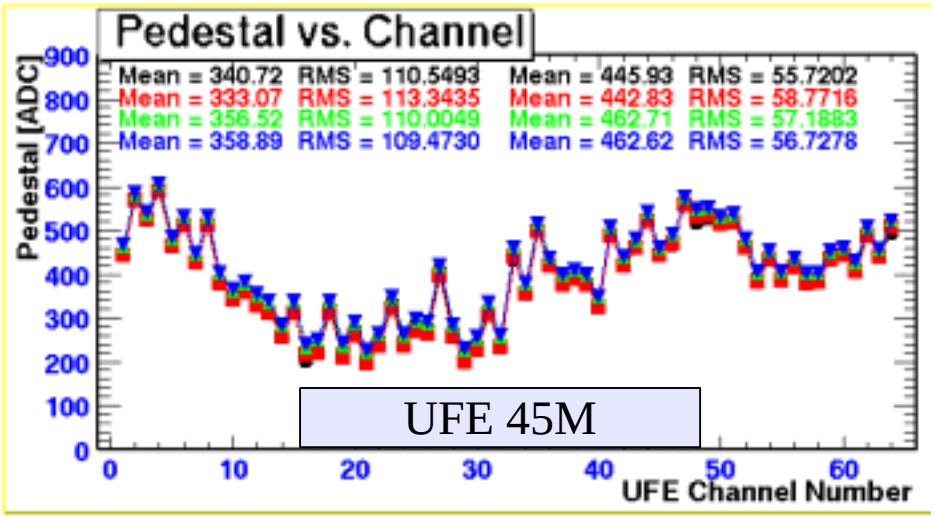


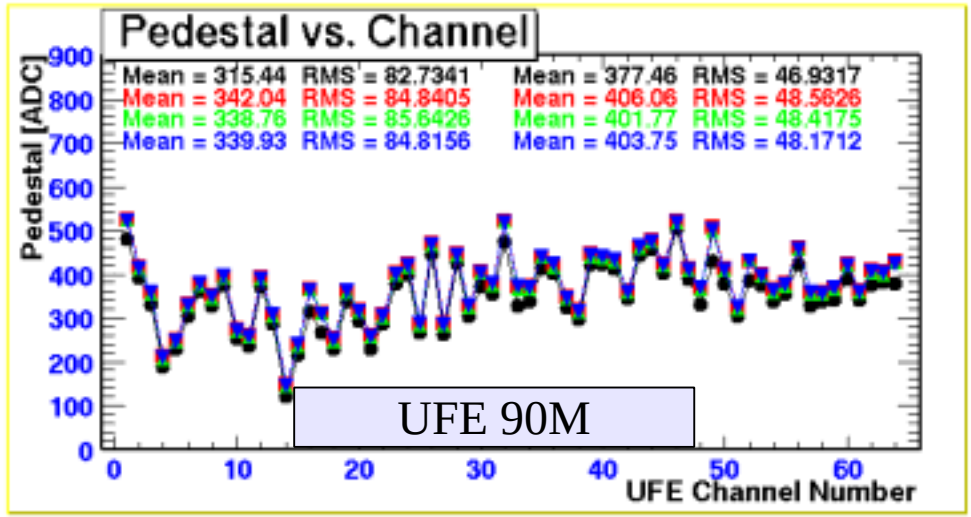
Space Qualification Tests

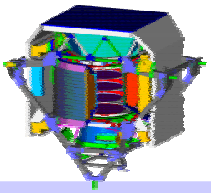
Measurements during vibrations





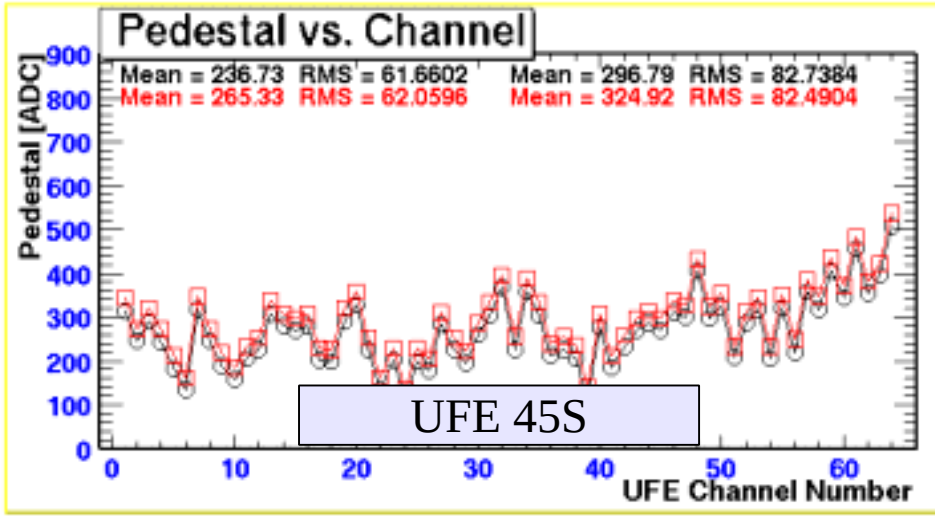


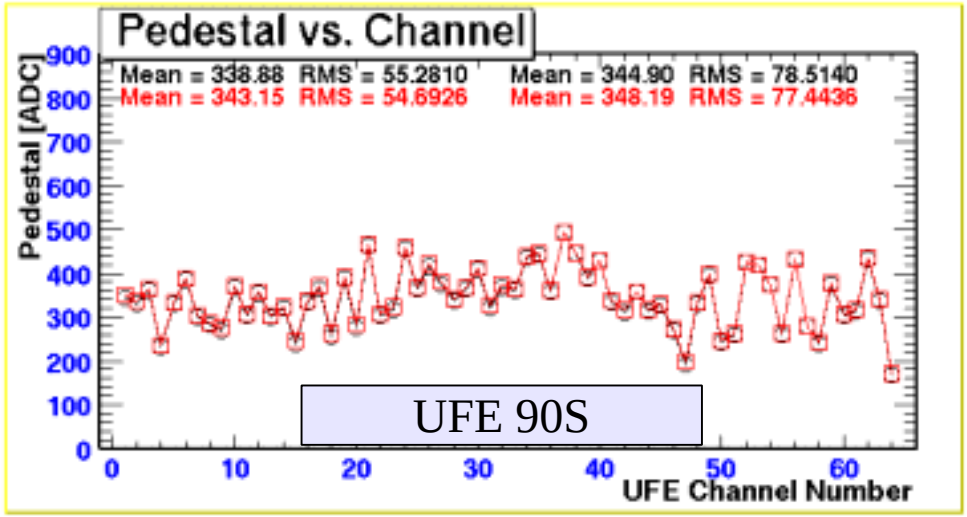


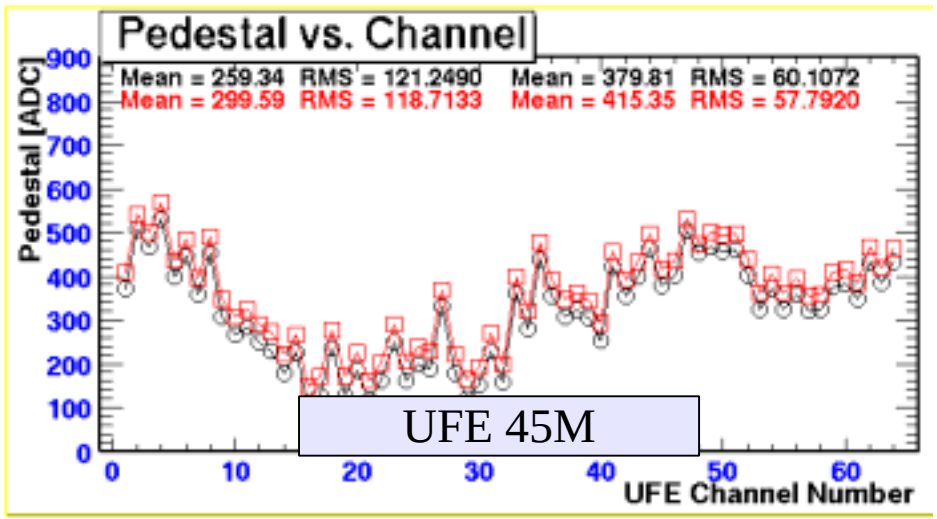


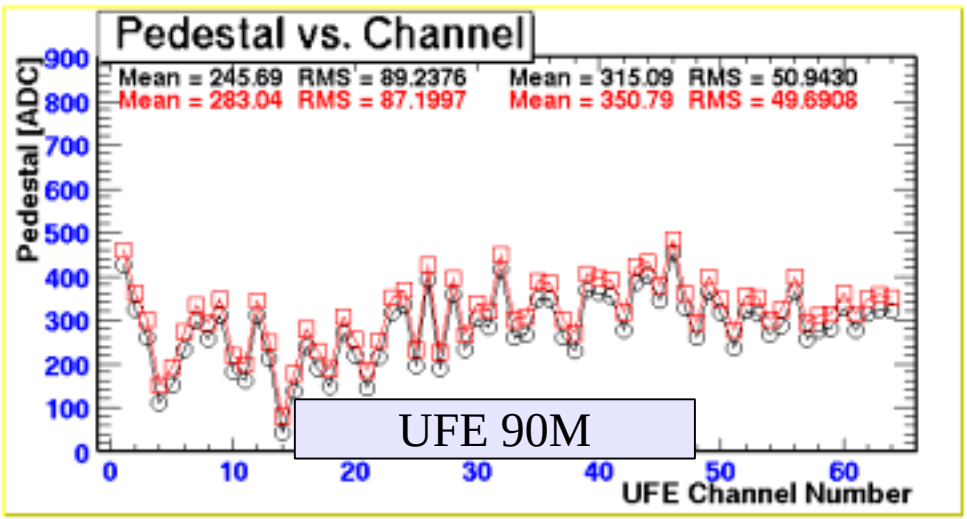
Space Qualification Tests

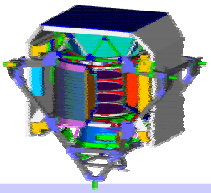
Pedestal measurements before / after vibrations





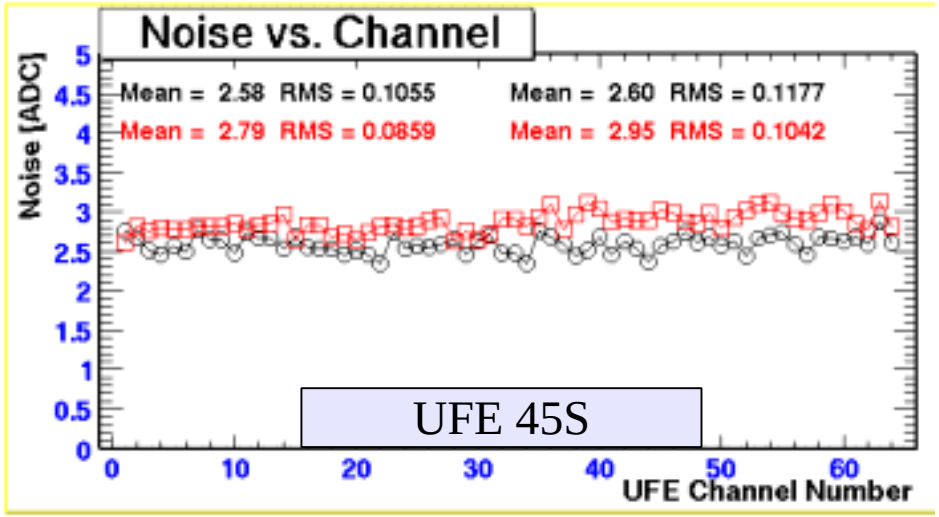


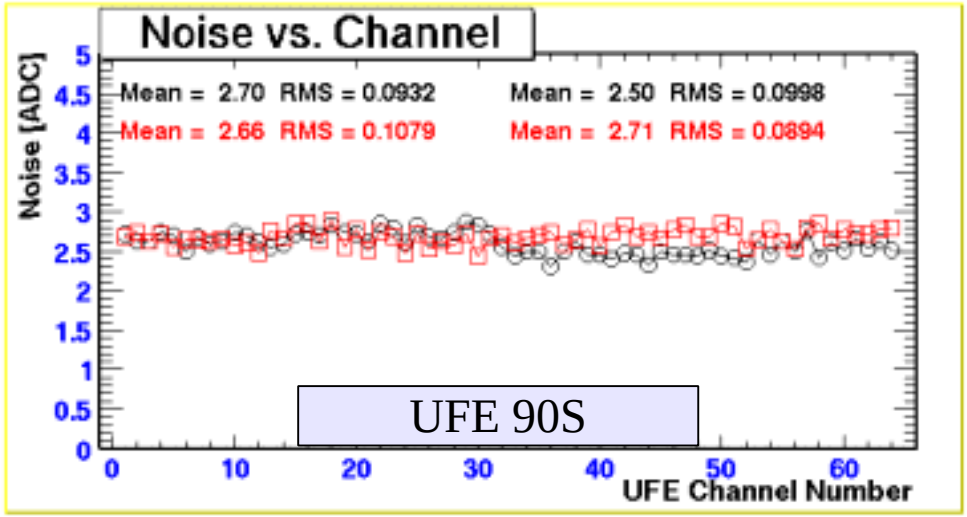


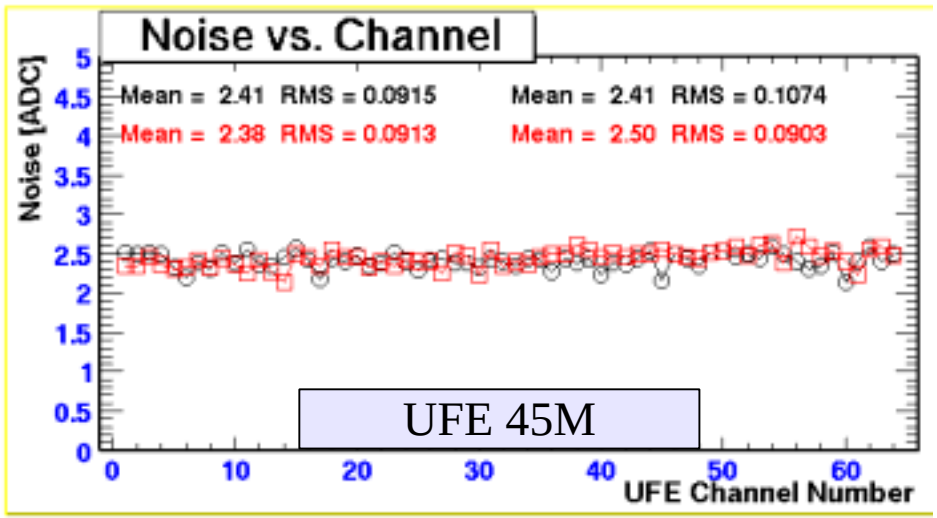


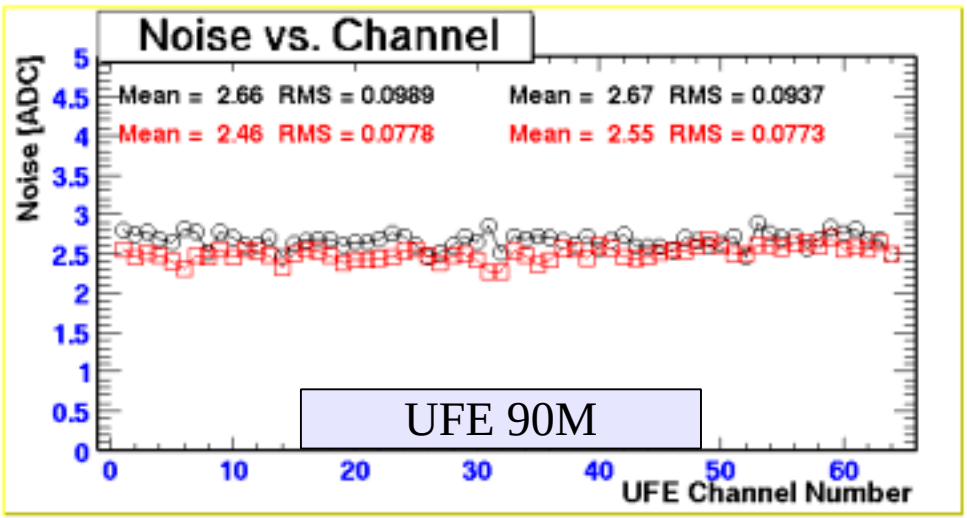
Space Qualification Tests

Noise measurements before / after vibrations









Electromagnetic Interference (EMI) Test

EMI Test @KMW Co. Munchen

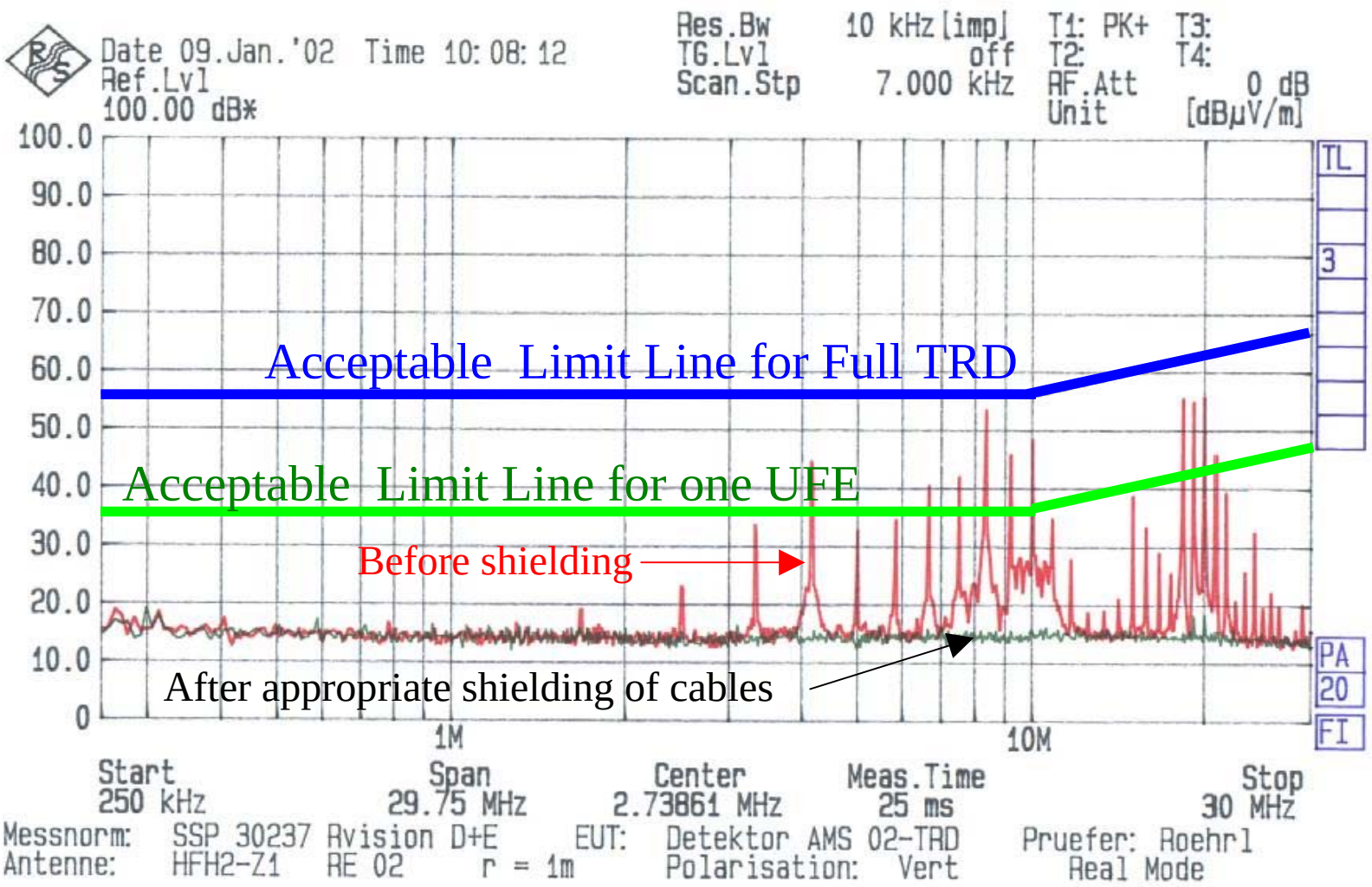
According to the
"Space Station Electromagnetic Emission and Susceptibility Requirements for the Electromagnetic Compatibility"

SSP30237 paragraphs RS02, RS03 and RE02

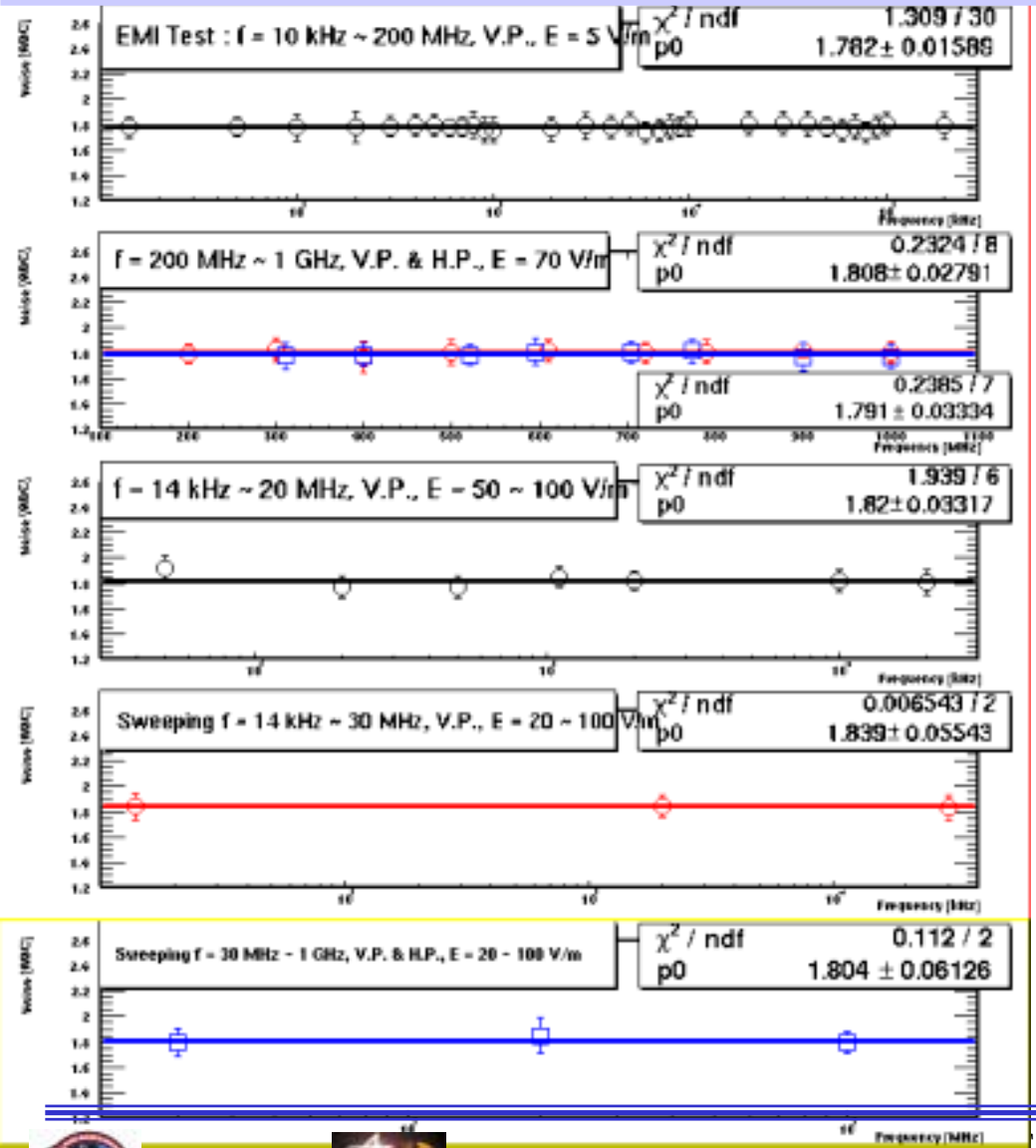
Wave : Horizontal / Vertical Polar.
Frequency range : 10 kHz ~ 1 GHz
Electric Field : 5 ~ 100 [V/ m]

Space Qualification Tests

Electromagnetic Emission from one UFE board



Space Qualification Tests
Electromagnetic Interference (EMI) : Susceptibility



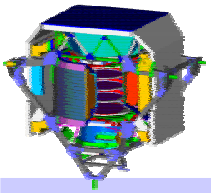
Freq. =10 kHz ~ 200MHz
$|E|_{rms}$ = 5 [V/m] w. V.P.
Noise $_{VP}$ = 1.782 +- 0.0159[ADC]

200MHz ~ 1GHz, 70 [V/m]
Noise $_{VP}$ = 1.808 +- 0.0279[ADC]
Noise $_{HP}$ = 1.791 +- 0.0333[ADC]

14kHz ~ 20MHz, 50~100[V/m]
Noise $_{VP}$ = 1.82 +- 0.0332[ADC]

Sweeping Freq. =14 kHz ~ 30MHz
$|E|_{rms}$ = 20 ~ 100[V/m] w. V.P.
Noise $_{VP}$ = 1.839 +- 0.0554[ADC]

Sweeping Freq. =30MHz ~ 1GHz
$|E|_{rms}$ = 20 ~ 100[V/m] w. V(H).P.
Noise $_{V\&H}$ = 1.804 +- 0.0613[ADC]



Space Qualification Tests

EMI / Mechanical Vibration : Summary

EMI :

Test was conducted according to SSP30237 paragraphs RS02, RS03 and RE02.

Results :

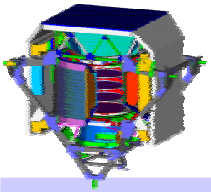
- No damage and no functional performance degradation.
- Shielding of the cables will be improved by use of double shields.
  (Cu 95% + aluminized kapton foil braid)
- Octagon-like housing wrapped with MLI.
- Proper termination of cables with MLI should be further worked out.

Mechanical Vibration :

Random test levels were chosen to according to AVT spectrum : $g_{RMS} = 6.8$ g

Results :

- FE electronics system successfully passed the sine / random vibrations.
- No damage and no functional performance degradation.



Space Qualification Tests

EMI / Mechanical Vibration : Summary

Next Plans:

Additional EMI + System Test with following equipment

- Octagon-like housing with 8 TRD-modules
- Prototype of the final MLI blanket
- Bundle of modified cables, shield properly terminated
- 2 UFE boards
- Higher TRD DAQ Electronics
- Gas and HV system

UFE Thermo-Vacuum Test

TRD Production: Summary

- **TRD Module production runs at nominal speed, i.e. 2 modules/day yield: up to now 100%, 15% of the modules are produced**
- **TRD support structure will be ready in June for module integration => CERN in August 2003 for TRD system test**
- **For the TRD FE electronic the space qualification has started EMI test successful, TRD FE electronic inside specs**